Five Protocol Changes You're Too Scared to Make

Premier Practices and Practicalities for Pragmatic Prehospital Professionals

Peter Antevy, MD

EMS Medical Director

BROWARD COLLEGE

Speaker Disclosure

handtevy

Founder & Chief Medical Officer

RSI vs. DSI

“RSI works well for us”

ENTER….

Mr. Game Changer

Jeff Jarvis, MD

What’s the Difference?

Rapid Sequence Induction (RSI)

Hypoxia Pre-Post Paralytic

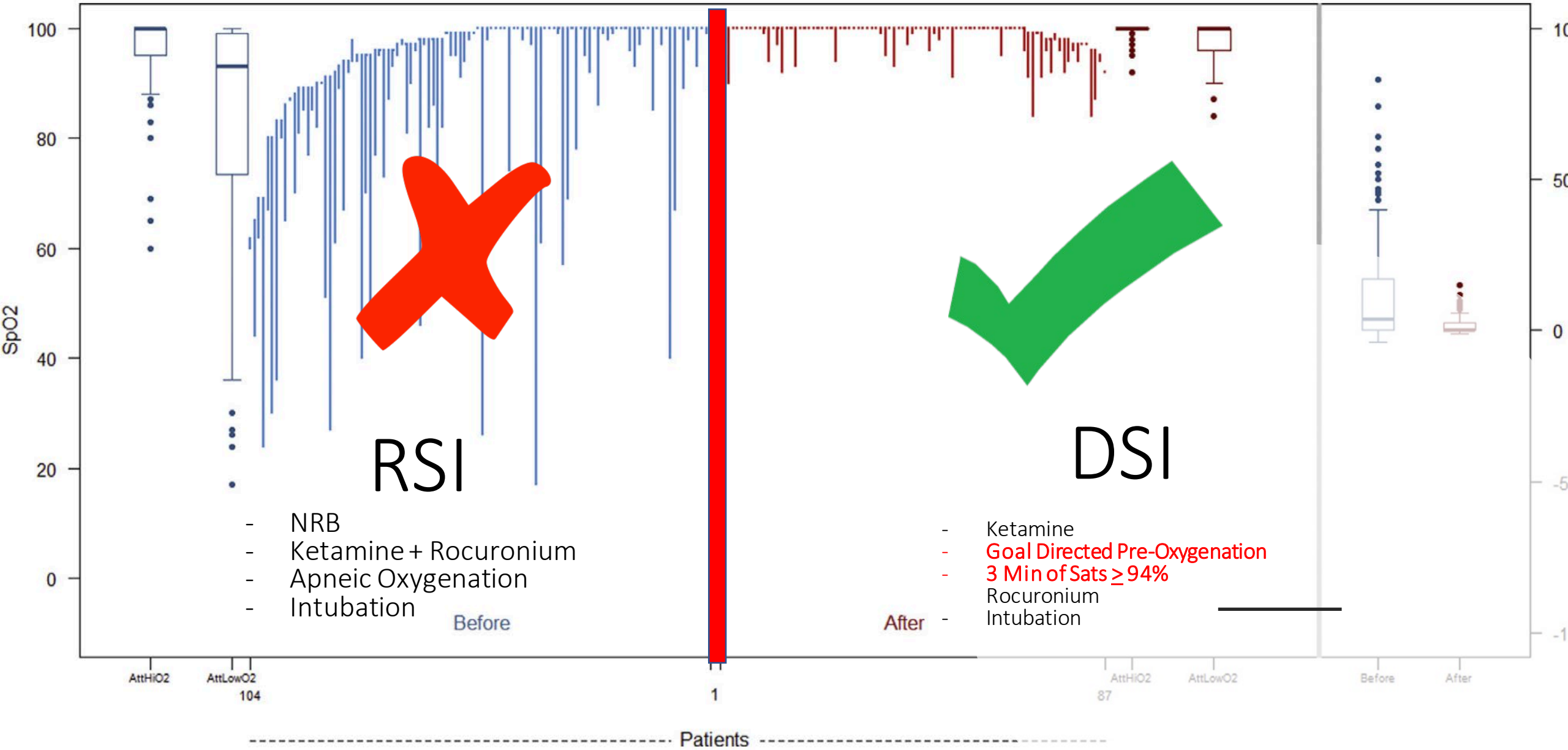
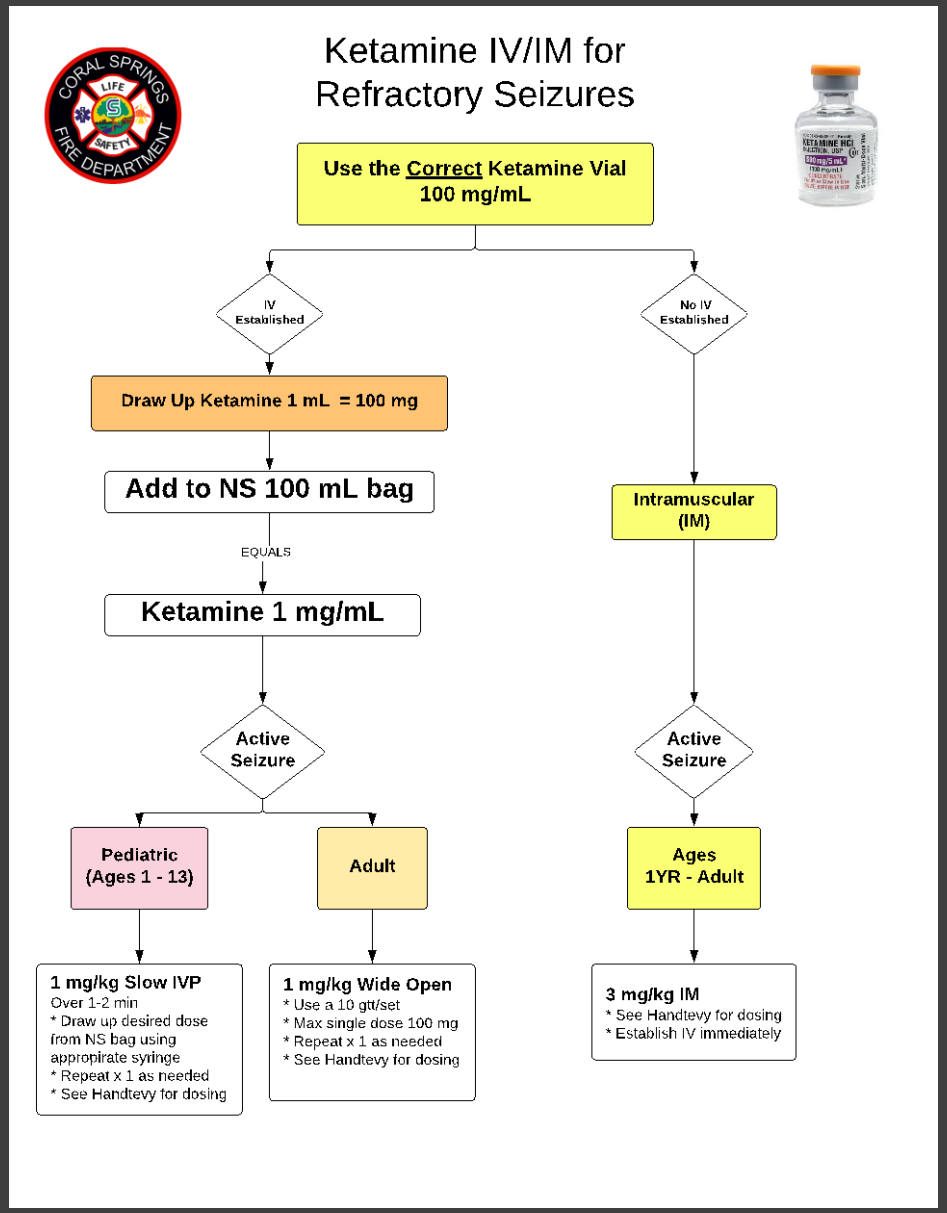


Figure. Waterfall plot.

Refractory Status Epilepticus



Ketamine for Refractory Status Epilepticus

“No published data”

Ketamine for Refractory Status Epilepticus

Clinical Safety and Feasibility of a Prehospital Protocol for:

Termination of Benzodiazepine-Resistant Status Epilepticus with Parenteral Ketamine Administration

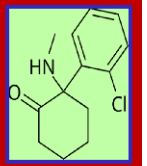
Kenneth A. Scheppke, MD[1,2] Paul E. Pepe, MD, MPH[1,2] Peter M. Antevy, MD[1,2] Michael Permutter, BA, NRP[2]
Sebastian Garay, EMT-P[1] Eric Scheppke[1] Juan Cardona, EMT-P[2] Lazaro Ojeda, EMT-P[2] Charles Coyle, EMT-P[1]
[1]*Palm Beach County Fire Rescue*, West Palm Beach, FL; [2]*Coral Springs – Parkland Fire Rescue Department, Broward County , FL*

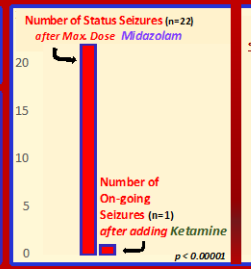
INTRODUCTION:
Benzodiazepines remain the cornerstone treatment for seizures, in-hospital and prehospital. However, paramedics generally do not carry (or routinely use) other pharmacological tools for seizures refractory to benzodiazepines. While ketamine use in-hospital has been reported for refractory status seizures, data are lacking for supporting analogous prehospital use.

The purpose of this study was to report paramedic experience with the use of ketamine for treatment of seizures refractory to parenteral midazolam.

METHODS:
Using data from two proximal (but separate) EMS agencies over 3 years (January 2017 - December 2019), patients were entered into the study when they had received parenteral ketamine for midazolam-resistant seizures (defined as persisting convulsions after a 10 mg cumulative dosing of midazolam in adults --- or an equivalent weight-based dose in children). The standing protocol called for administration of ketamine at a dose of 100 mg IV / IO in adults (or 1 mg/kg IV / IO for children) or 3 mg/kg IM (adults and children). The primary outcome was the frequency of sustained seizure termination prior to hospital arrival following the ketamine administration. Secondary outcomes included the presence of oxygen desaturation ($SpO_2 \leq 90\%$) and frequency of the need for invasive airway management following ketamine.

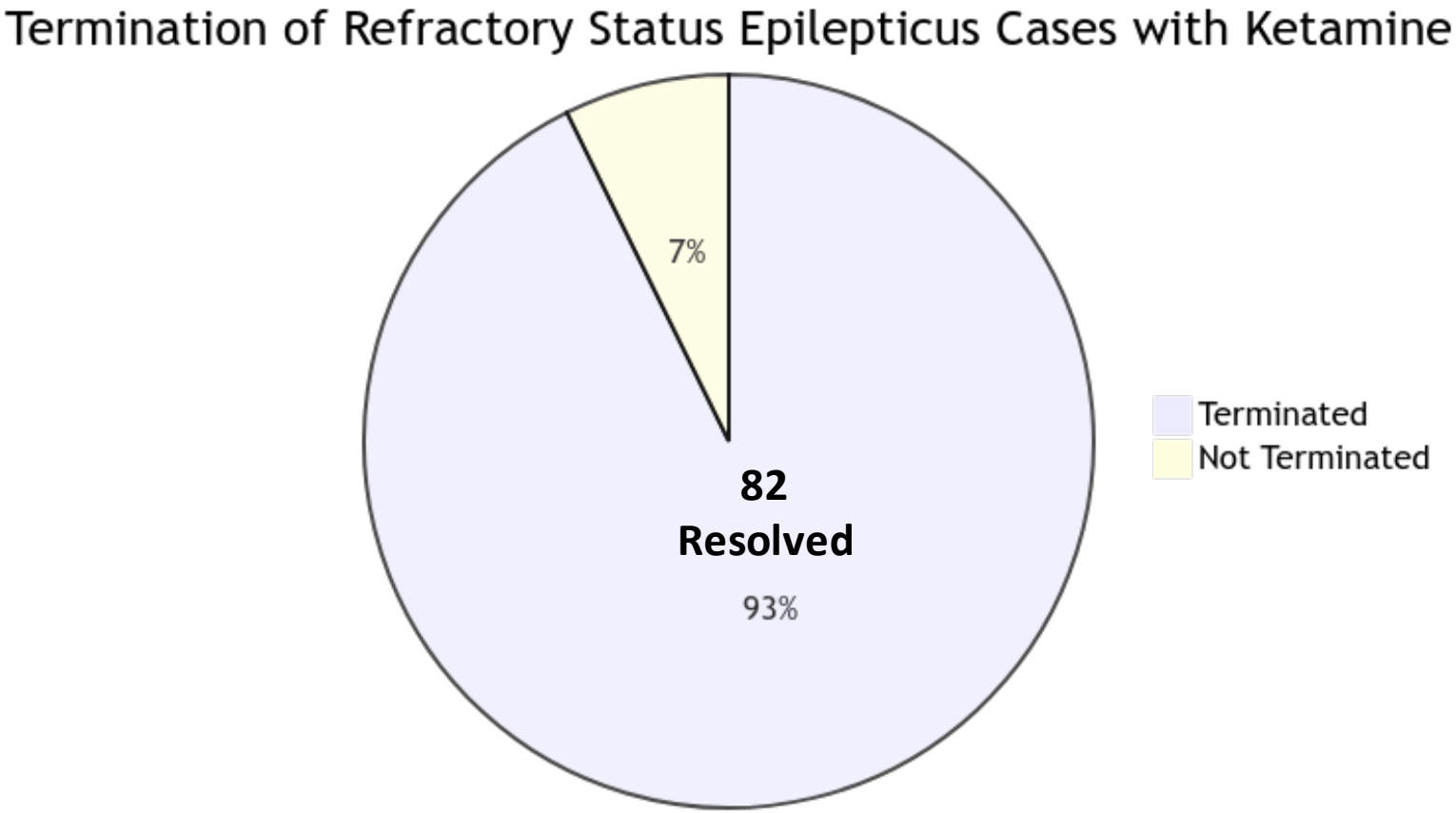
RESULTS: Of the 22 patients meeting criteria (mean age 37.5 years; range 5 to 86), 77% (n=17) were female. Ketamine was provided IV in 13, IM in 6 and IO in 3 patients. **Sustained termination of midazolam-refractory seizure activity occurred in 95.5%** (21/22) **following ketamine** ($p < .00001$) and the terminated seizures did not recur. In the one non-termination case, seizures persisted but became less frequent. O_2 de-saturation (SpO_2 ≤90% observed at any time) occurred in 5 patients (but prior to adding ketamine in 2 of the 5). Normalization of SpO2 occurred in all 5 cases using only supplemental O_2 in 3 cases, bag-valve-mask assisted ventilation in 1 and endotracheal intubation in 1 (actually placed for compromised airway reflex). No discernible differences were delineated between the two EMS agencies, although one agency exclusively used IM and IO routes.





CONCLUSIONS
Among patients treated in the prehospital setting for persistent seizures refractory to significant doses of parenteral midazolam, the addition of parenteral ketamine was not only exceptionally effective in terms of achieving and sustaining prehospital termination of status seizure activity (in >95%), but O_2 desaturation after ketamine was only observed in a small percentage of cases (13.6%) and it was readily reversed in every circumstance. In contrast to other studies of status epilepticus, an incidental finding here was that women constituted the clear majority of cases (vs. men in other investigations).

Palm Beach County Fire Rescue Data



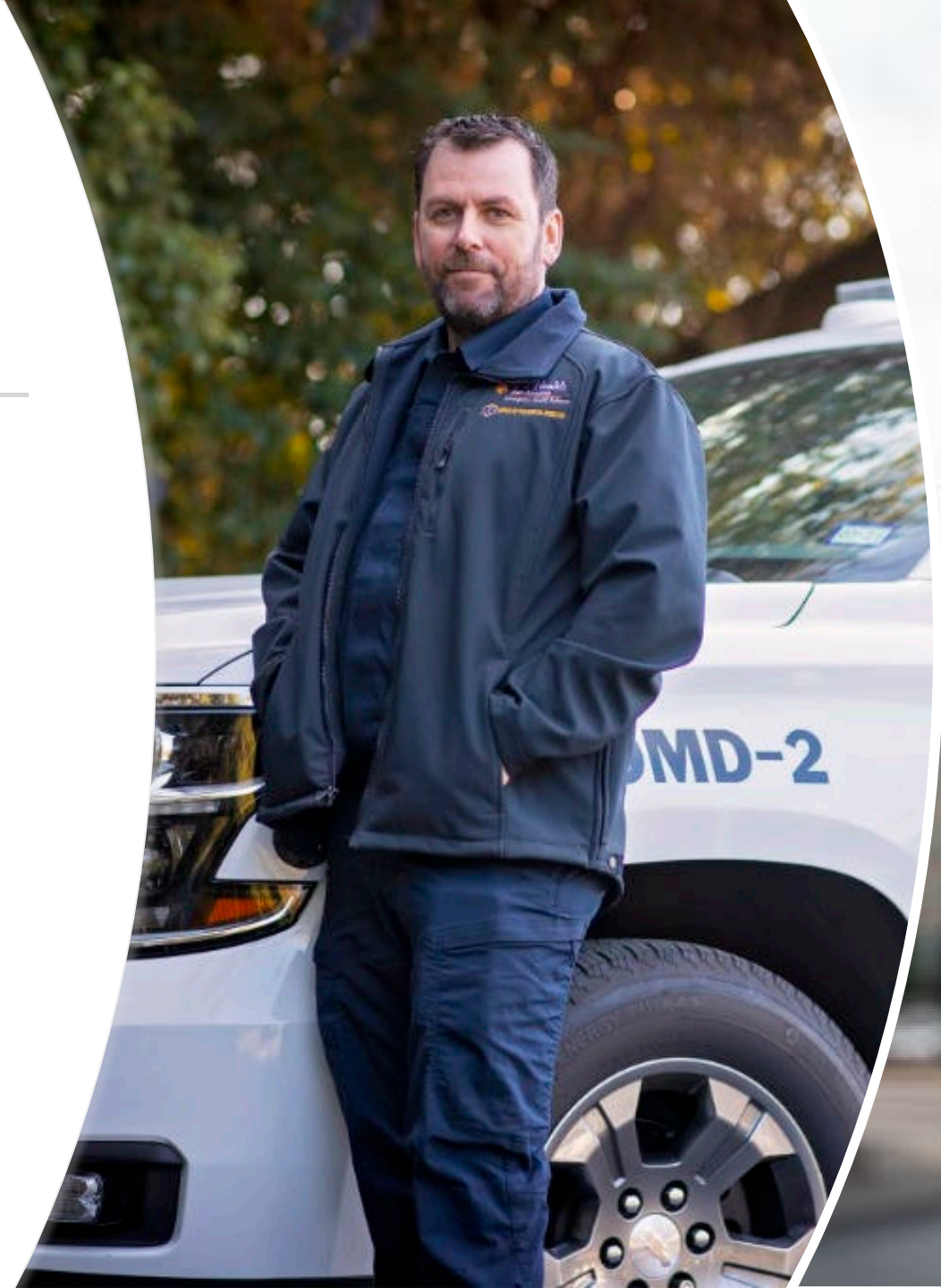
76 Total Cases

Whole Blood in EMS

“Too Expensive / Difficult”

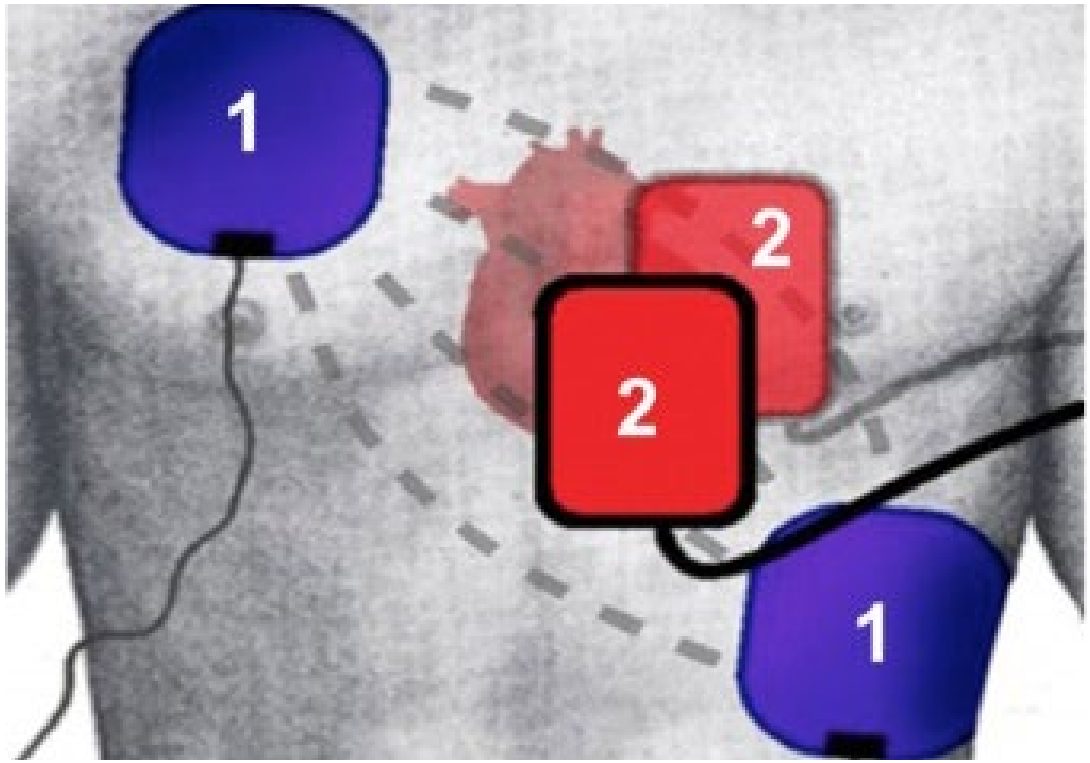
CJ Winckler, MD

- San Antonio Fire Dept.



If Whole Blood was Administered Before Arrest….

Survival > 90%



Double Sequential Defibrillation (DSD)

Refractory VF

“Manufacturer Won’t Allow It”

Sheldon Cheskes, MD

University of Toronto

Double Sequential External Defibrillation in Refractory VF:

The DOSE VF RCT

November
6th 2022

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Defibrillation Strategies for Refractory Ventricular Fibrillation

Sheldon Cheskes, M.D., P. Richard Verbeek, M.D., Ian R. Drennan, A.C.P., Ph.D., Shelley L. McLeod, Ph.D., Linda Turner, Ph.D., Ruxandra Pinto, Ph.D., Michael Feldman, M.D., Ph.D., Matthew Davis, M.D., Christian Vaillancourt, M.D., Laurie J. Morrison, M.D., Paul Dorian, M.D., and Damon C. Scales, M.D., Ph.D.

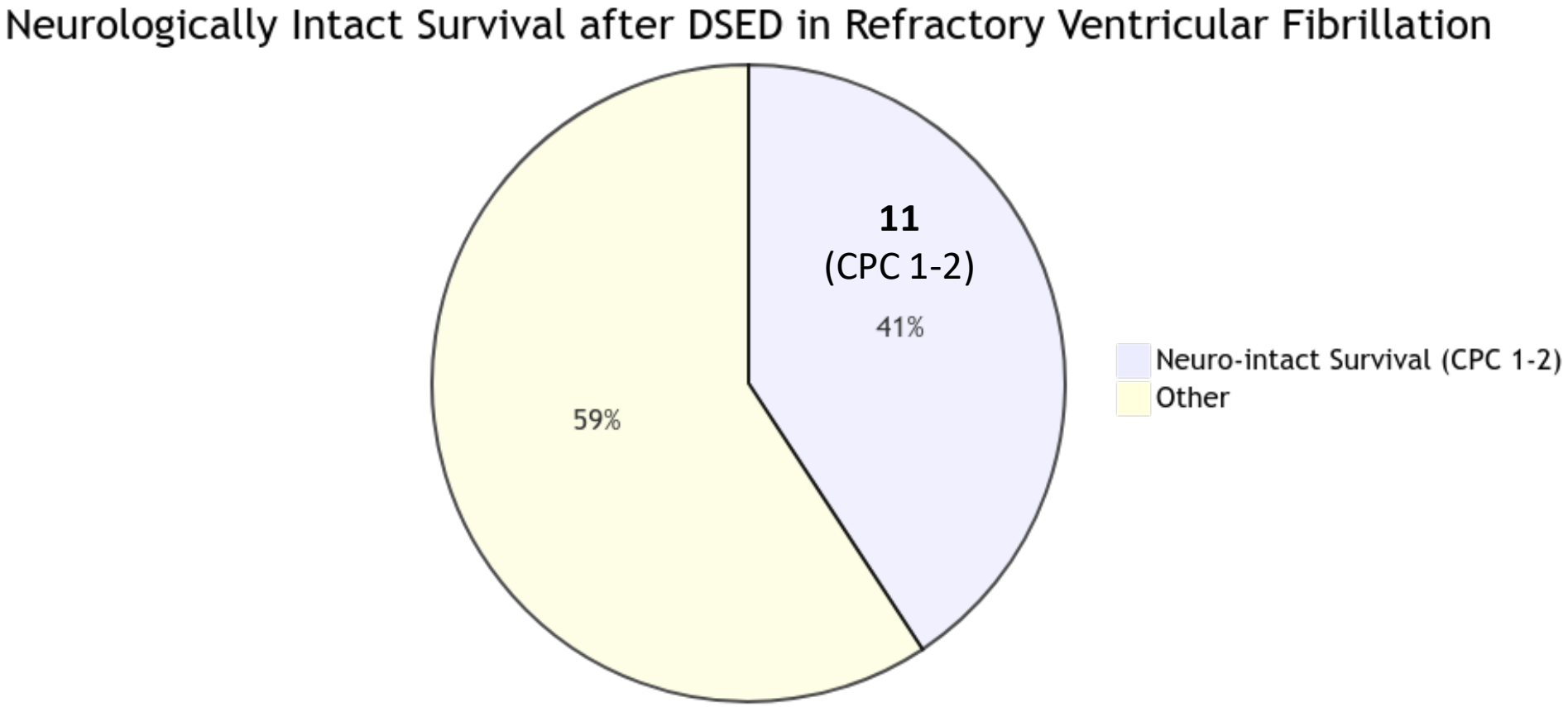
DOSE VF Trial – Results

Table 3. Primary and Secondary Outcomes.

Outcome	Standard Defibrillation (N=136)	VC Defibrillation (N=144)	DSED (N=125)	Adjusted Relative Risk (95% CI)*	
				DSED vs. Standard	VC vs. Standard
	number of patients/total number (percent)				
Survival to hospital discharge†				2.21 (1.33–3.67)	1.71 (1.01–2.88)
Termination of ventricular fibrillation	92/136 (67.6)	115/144 (79.9)	105/125 ( )	1.25 (1.09–1.44)	1.18 (1.03–1.36)
ROSC	36/136 (26.5)	51/144 (35.4)	58/125 (46.4)	1.72 (1.22–2.42)	1.39 (0.97–1.99)
Modified Rankin scale score ≤2†‡	15/134 (11.2)	23/142 (16.2)	34/124 (27.4)	2.21 (1.26–3.88)	1.48 (0.81–2.71)

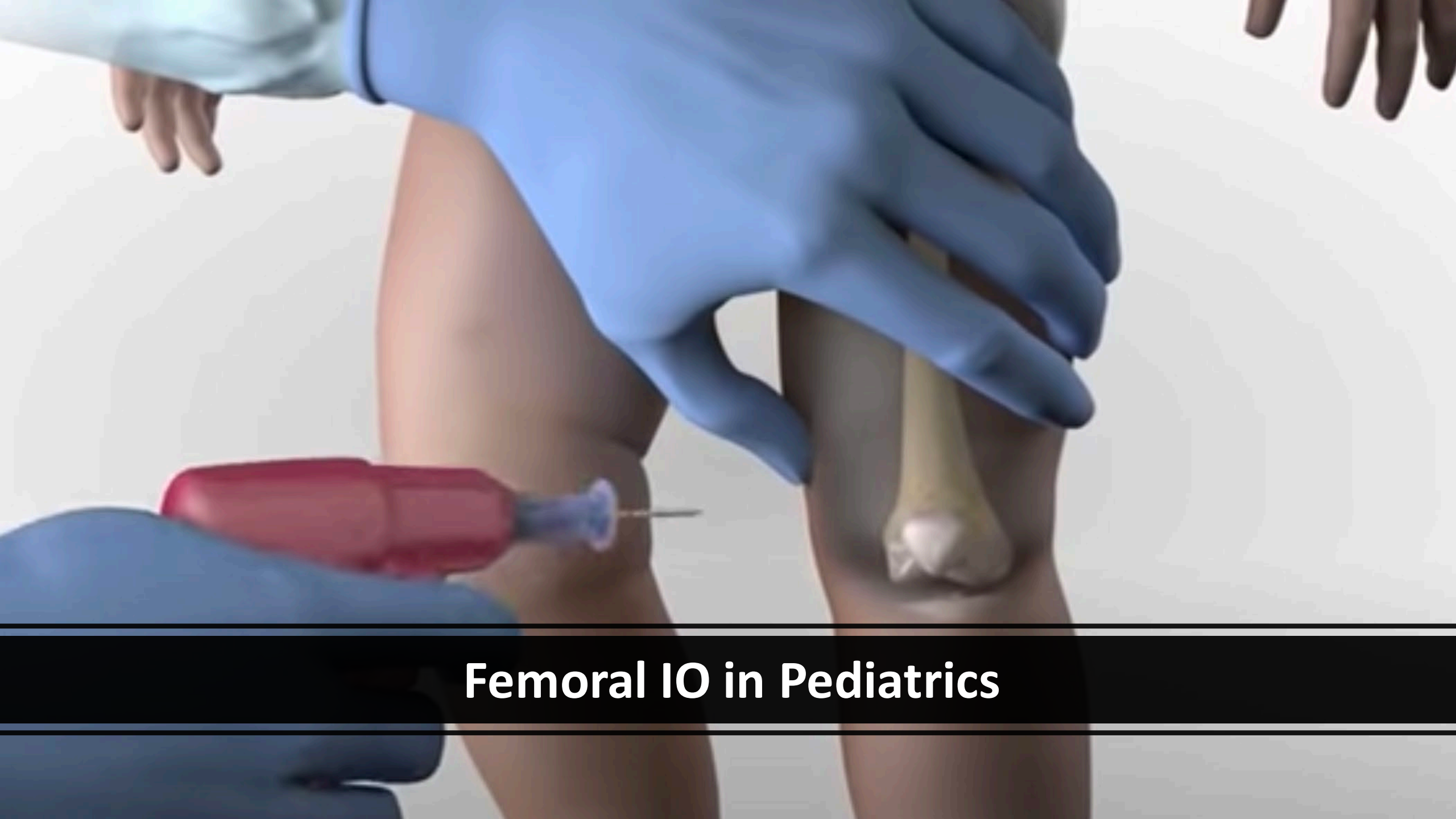
More than Double Neuro Intact Survival!

Palm Beach County Fire Rescue Data



27 Total Cases

* Unpublished Data



Femoral IO in Pediatrics

“I don’t have a leg to train on”

RESUSCITATION 145 (2019) 1 –7

Available online at www.sciencedirect.com

Resuscitation

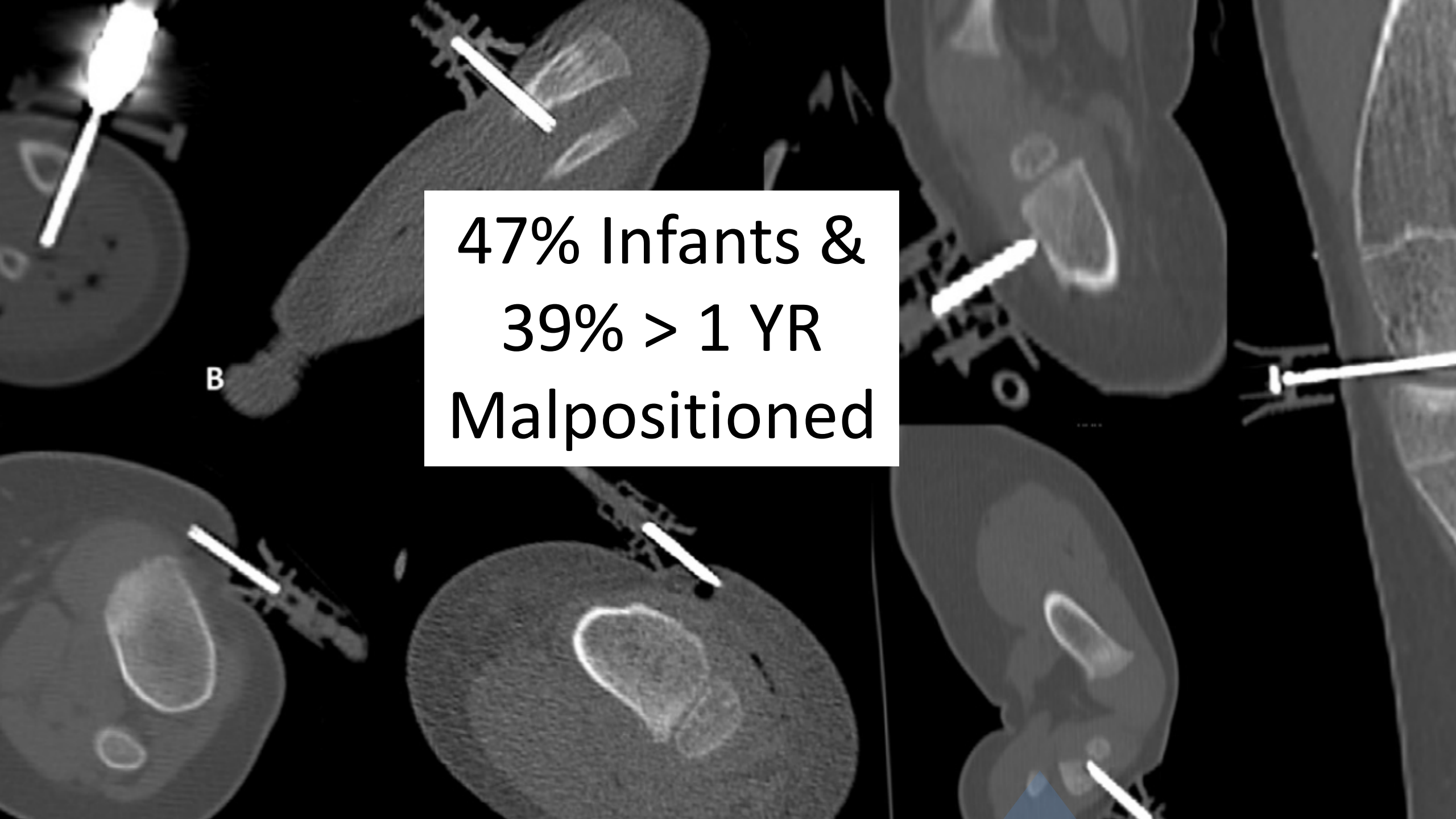
journal homepage: www.elsevier.com/locate/resuscitation

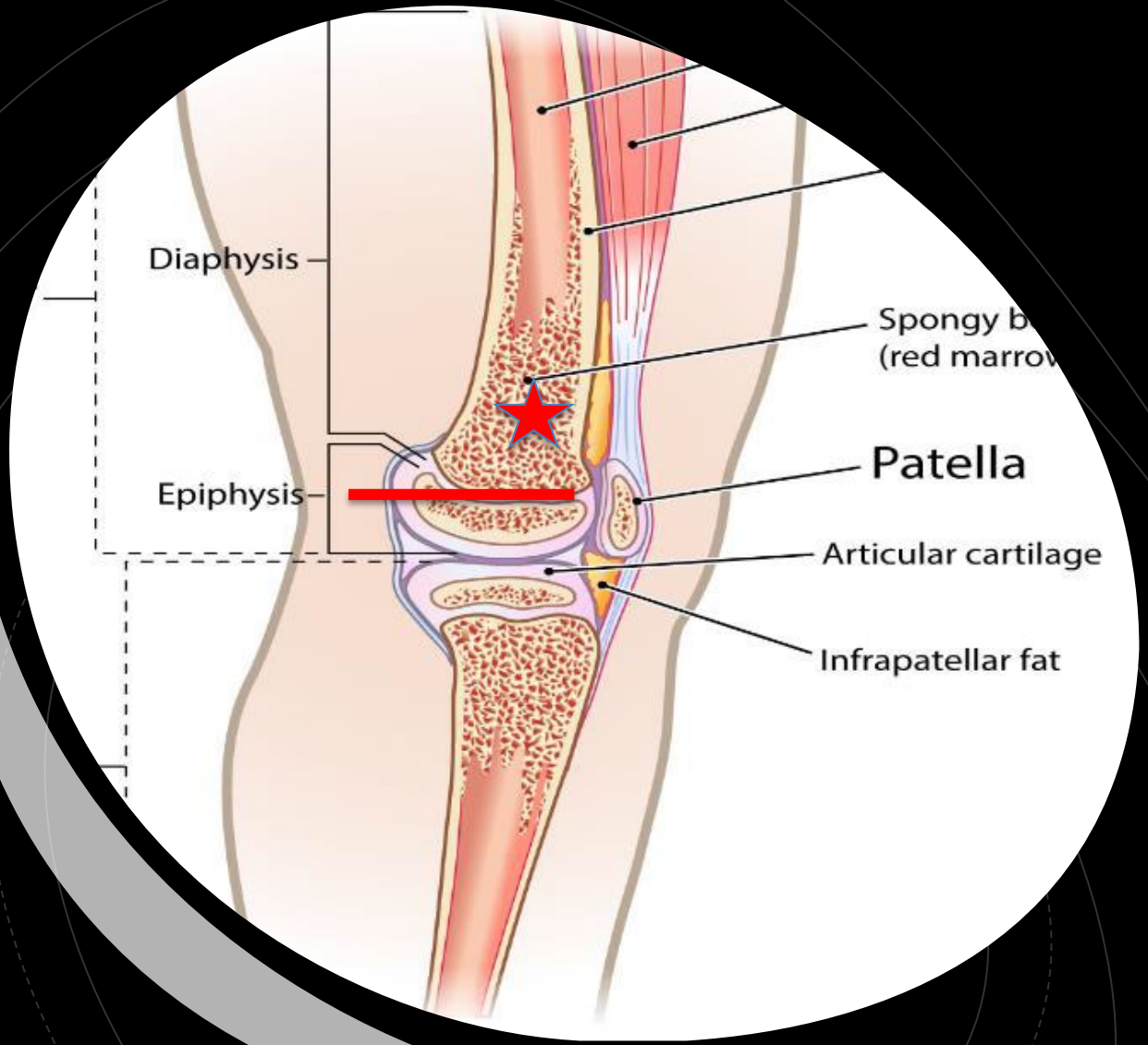
Clinical paper

Intraosseous needles in pediatric cadavers: Rate of malposition

Daniel Maxien[a,e,*], *Stefan Wirth*[a,d], *Oliver Peschel*[c], *Alexander Sterzik*[f], *Sonja Kirchhoff*[g], *Uwe Kreimeier*[b], *Maximilian F. Reiser*[a], *Fabian G. Mück*[d]

September 2019

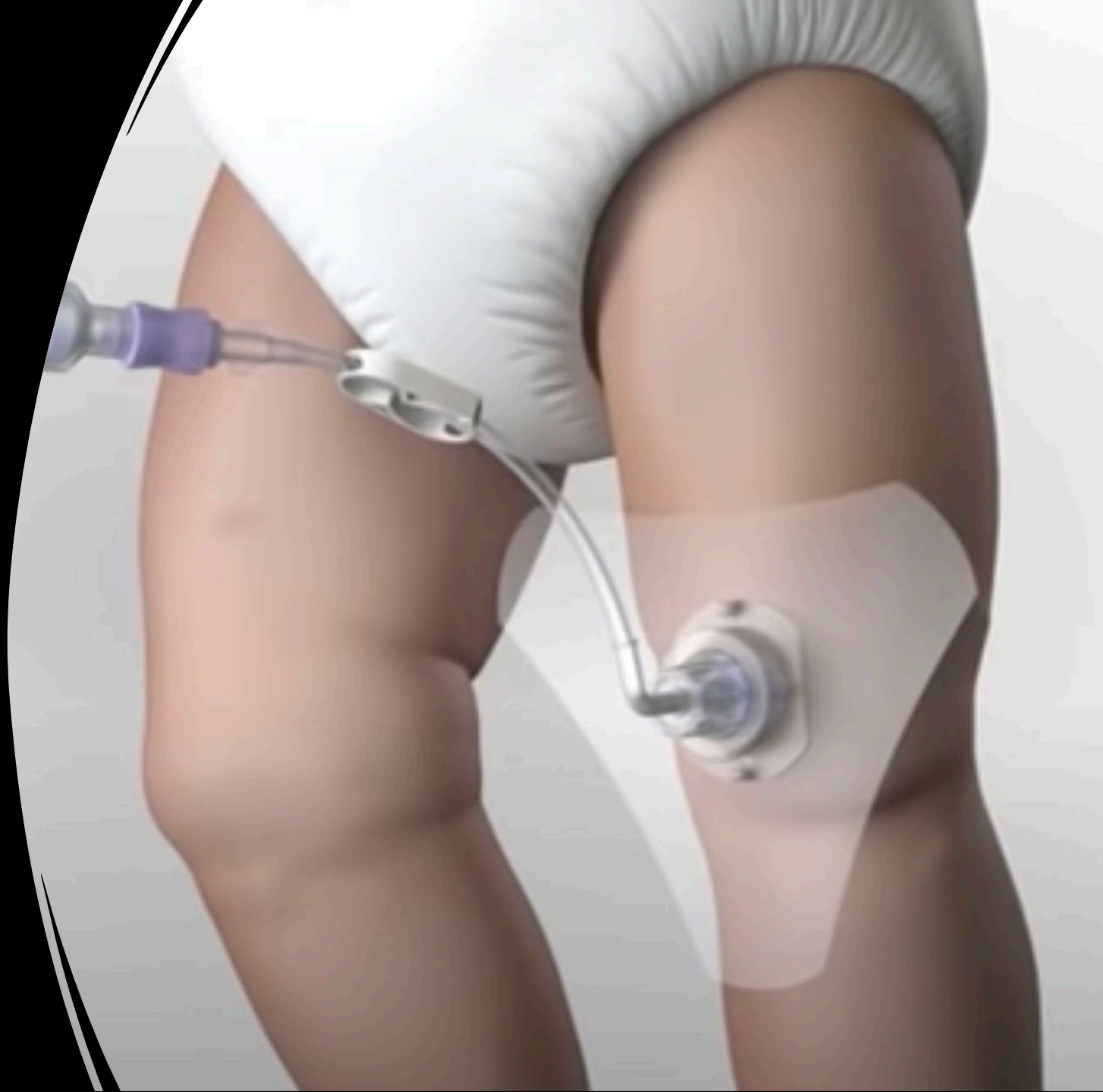

B
47% Infants &
39% > 1 YR
Malpositioned



Distal Femur *Pediatric Landmarks*

Distal Femur
Clinical Pearls

- Recommended in the unconscious patient (arrest)
- Is too painful in the awake patient compared to the proximal tibia
- Do not use pink (15 mm) needle



Five Protocol Changes You're Too Scared to Make

Peter Antevy, MD

EMS Medical Director

BROWARD COLLEGE

EMS State of the Science XXIV

A Gathering of Eagles 2022

Practice Changing Studies…

That you should ignore & throw out the door

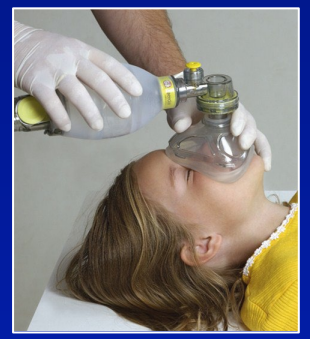
Peter Antevy, MD

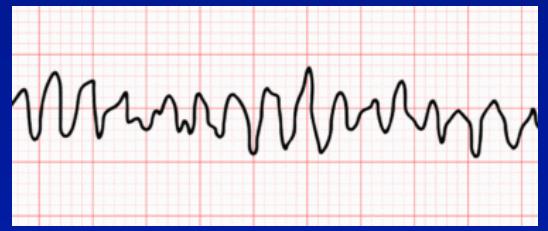
EMS Medical Director

@HandtevyMD

“The Landmark Papers”

1. Ventilations in Pediatric Arrest
2. Fluids in Sepsis
3. Pre-hospital Whole Blood
4. Pre-hospital Antibiotics for Sepsis
5. Epinephrine in Shockable Rhythms





1

Should We Rapidly Ventilate Pediatric Arrest?

Circulation

2b **WEAK**	C-LD **LIMITED DATA**	9. When performing CPR in infants and children with an advanced airway, it may be reasonable to target a respiratory rate range of 1 breath every 2–3 s (20–30 breaths/min), accounting for age and clinical condition. Rates exceeding these recommendations may compromise hemodynamics.[5]

The Data That Changed The Guidelines

Reference #5

Ventilation Rates and Pediatric In-Hospital Cardiac Arrest Survival Outcomes

Robert M. Sutton, MD, MSCE[1]; Ron W. Reeder, PhD[2]; William P. Landis, BSE[1]; Kathleen L. Meert, MD[3]; Andrew R. Yates, MD[4]; Ryan W. Morgan, MD, MTR[1]; John T. Berger, MD[5]; Christopher J. Newth, MD, FRACP[6]; Joseph A. Carcillo, MD[7]; Patrick S. McQuillen, MD[8]; Rick E. Harrison, MD[9]; Frank W. Moler, MD[10]; Murray M. Pollack, MD[5,11]; Todd C. Carpenter, MD[12]; Daniel A. Notterman, MD[13]; Richard Holubkov, PhD[2]; J. Michael Dean, MD[2]; Vinay M. Nadkarni, MD, MS[1]; Robert A. Berg, MD[1]; for the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Collaborative Pediatric Critical Care Research Network (CPCCRN)

Crit Care Med. 2019 Nov;47(11):1627-1636.

Event Characteristic	Overall ($n = 47$)	Survival to Hospital Discharge		p
		Yes ($n = 18$)	No ($n = 29$)	

- **97% in the ICU**
- **100% Intubated**
- **77% on a Pressor**

*** All patients had an ETT and $ETCO_2$ monitoring in place at the time of the arrest

Ventilation Rates and Pediatric In-Hospital Cardiac Arrest Survival Outcomes

Robert M. Sutton, MD, MSCE[1]; Ron W. Reeder, PhD[2]; William P. Landis, BSE[1]; Kathleen L. Meert, MD[3]; Andrew R. Yates, MD[4]; Ryan W. Morgan, MD, MTR[1]; John T. Berger, MD[5]; Christopher J. Newth, MD, FRACP[6]; Joseph A. Carcillo, MD[7]; Patrick S. McQuillen, MD[8]; Rick E. Harrison, MD[9]; Frank W. Moler, MD[10]; Murray M. Pollack, MD[5,11]; Todd C. Carpenter, MD[12]; Daniel A. Notterman, MD[13]; Richard Holubkov, PhD[2]; J. Michael Dean, MD[2]; Vinay M. Nadkarni, MD, MS[1]; Robert A. Berg, MD[1]; for the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development Collaborative Pediatric Critical Care Research Network (CPCCRN)

Crit Care Med. 2019 Nov;47(11):1627-1636.

Preexisting conditions, *n* (%)				
Respiratory insufficiency	36 (77)	13 (72)	23 (79)	0.726[a]
Hypotension	39 (83)	15 (83)	24 (83)	1.000[a]
Not reported	13 (28)	5 (28)	8 (28)	
Congestive heart failure	7 (15)	4 (22)	3 (10)	0.403[a]
				1.000[a]
				0.662[a]
				1.000[a]
Malignancy	1 (2)	0 (0)	1 (3)	1.000[a]
Congenital heart disease	28 (60)	14 (78)	14 (48)	0.068[a]

60% had preexisting CHD

Ventilation Rates and Pediatric In-Hospital Cardiac Arrest Survival Outcomes

Robert M. Sutton, MD, MSCE[1]; Ron W. Reeder, PhD[2]; William P. Landis, BSE[1];
Kathleen L. Meert, MD[3]; Andrew R. Yates, MD[4]; Ryan W. Morgan, MD, MTR
Christopher J. Newth, MD, FRACP[6]; Joseph A. Carcillo, MD[7]; Patric
Rick E. Harrison, MD[9]; Frank W. Moler, MD[10]; Murray M. P
Daniel A. Notterman, MD[13]; Richard Holubkov, PhD
Vinay M. Nadkarni, MD, MS[1]; Robert A. Berg
of Child Health and Human Develop
(CPCCRN)

9. When performing CPR in infants and children with an advanced airway, it may be reasonable to target a respiratory rate range of 1 breath every 2–3 s (20–30 breaths/min), accounting for age and clinical condition. Rates exceeding these recommendations may compromise hemodynamics.[5]

-1636.

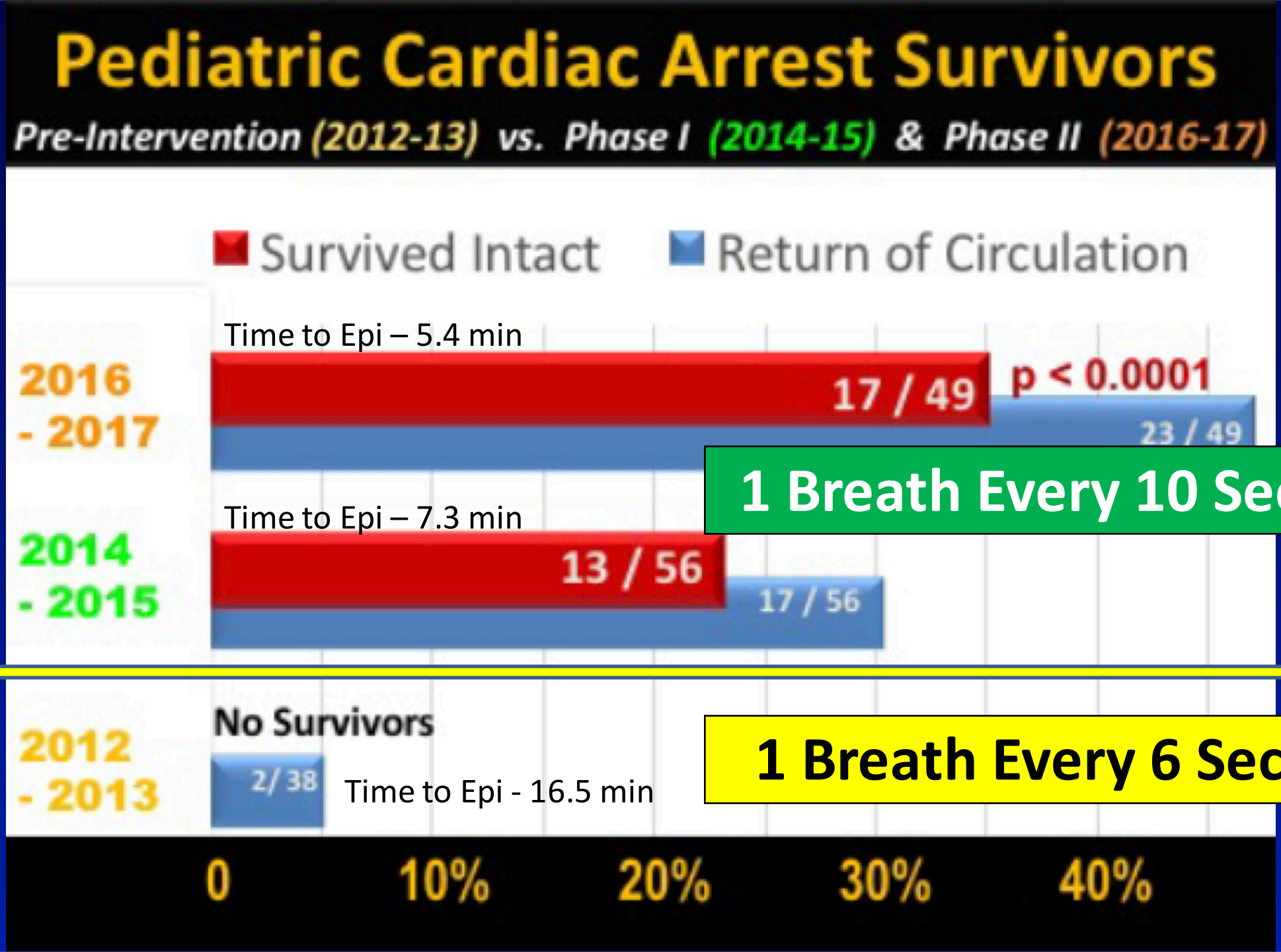
Pr		Survival to Hospital Discharge		
	47)	Yes ($n = 18$)	No ($n = 29$)	p

2b

C-LD

presented in

ymptomatic Bradycardia



1 Breath Every 10 Seconds

1 Breath Every 6 Seconds

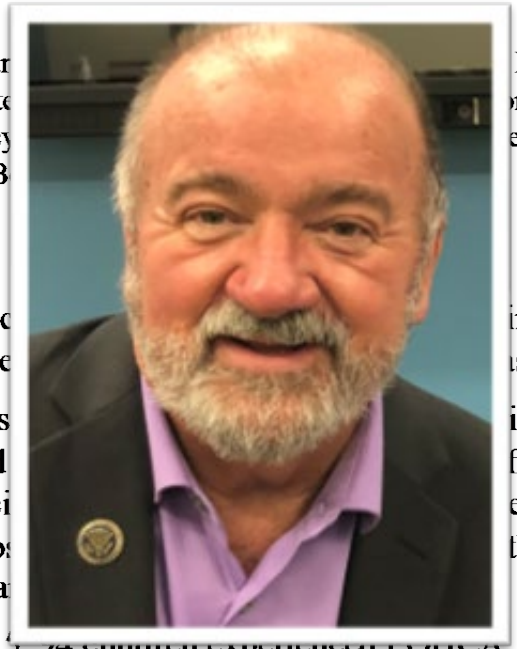
Resuscitation, Feb. 2019

Original Investigation

Early On-Scene Management of Pediatric Out-of-Hospital Cardiac Arrest Can Result in Improved Chances for Neurologically-Intact Survival

Paul R. Banerjee, DO,[1,2] Latha Ganti, MD, MS, MBA,[2] Paul E. Pepe, MD, MPH,[1,3]
Amninder Singh, MD,[2] Abhishek Roka, MD,[2] Raf A. Vittone, EMT-P[1]

[1] Polk County Fire Rescue, 2470 Clower Lane, Bar M
Emergency Medicine Residency Program of Greate ri
Kissimmee, FL 34741 [3] Departments of Emergency e,
Southwestern Medical Center, 5323 Harry Hines B



ABSTRACT

Aim: To evaluate the frequency of neurologic ing
(POHCA) when comparing traditional early e si

Methods: Before 2014, emergency medical s id
for POHCA on-scene and rapidly transported fte
provider comfort levels with on-scene resusci ex
pressure ventilation. Frequency of SURV (hos th
on-scene care strategy to the ensuing two yea

Results: Between 01/01/2012 and 12/31/2015, 94 children experienced POHCA. There were no significant differences before and after the on-scene focus in terms of age, sex, etiology, presenting electrocardiograph, drug infusions or bystander-performed cardiopulmonary resuscitation and total scene times actually remained similar (14.3 vs. 17.67 minutes). SURV

2

Should We Give Fluids in Sepsis?

Circulation

Part 4: Pediatric Basic and Advanced Life Support

10. Fluid resuscitation in sepsis is based on patient response and requires frequent reassessment. Balanced crystalloid, unbalanced crystalloid, and colloid fluids are all acceptable for sepsis resuscitation. Epinephrine or norepinephrine infusions are used for fluid-refractory septic shock.

Recommendations for Fluid Resuscitation in Shock

COR	LOE	Recommendations
1	C-LD	1. Providers should reassess the patient after every fluid bolus to assess for fluid responsiveness and for signs of volume overload.[3–5]
2a	B-R	2. Either isotonic crystalloids or colloids can be effective as the initial fluid choice for resuscitation.[6]
2a	B-NR	3. Either balanced or unbalanced solutions can be effective as the fluid choice for resuscitation.[7–9]
2a	C-LD	4. In patients with septic shock, it is reasonable to administer fluid in 10-mL/kg or 20-mL/kg aliquots with frequent reassessment.[4]

Circulation. 2020 Oct; 142(suppl 2):S469–

“Reasonable” to give fluid in shock

Pre-Hospital Sepsis

Characterization of Children with Septic Shock Cared for by Emergency Medical Services

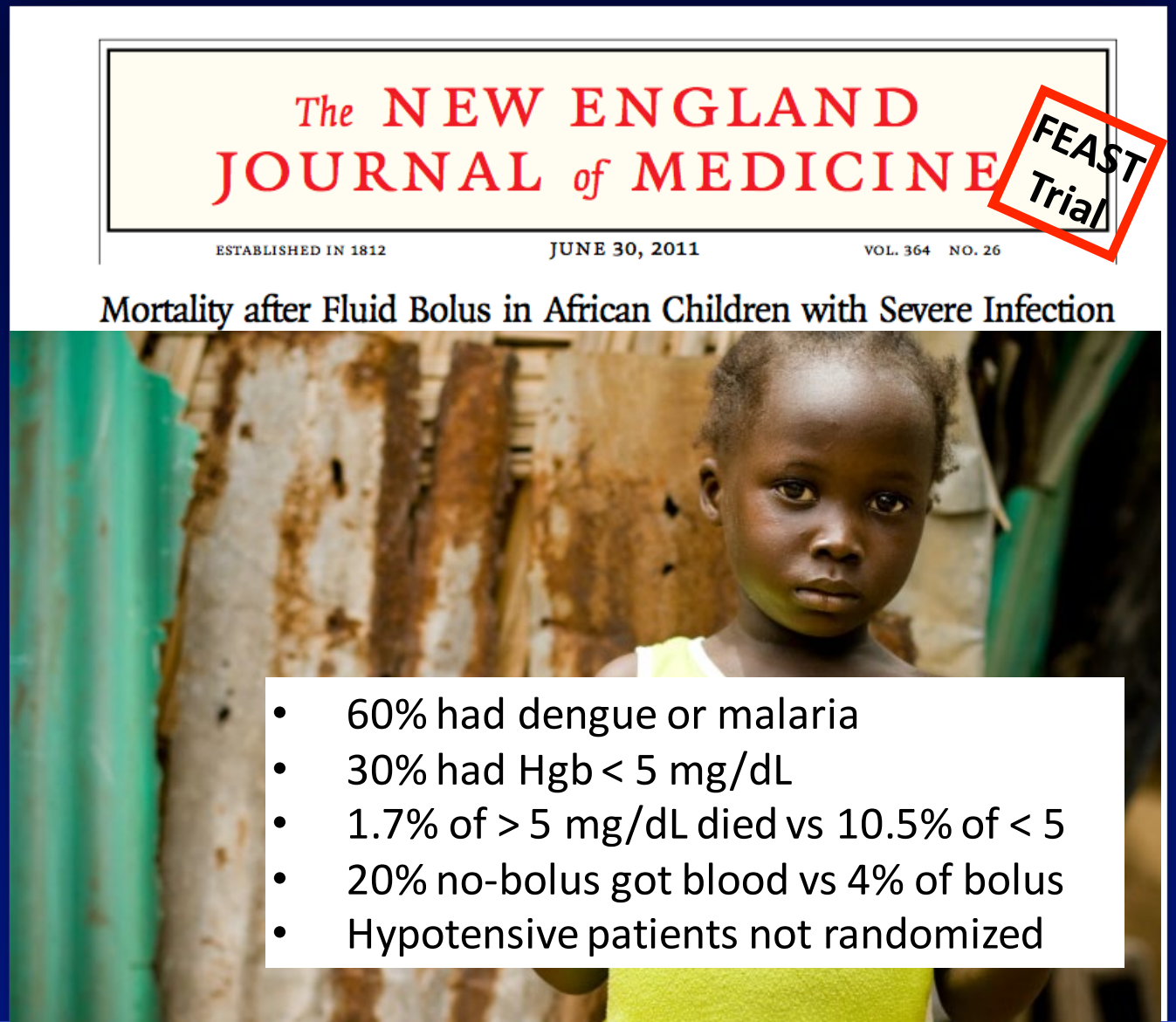
Holly E. Depinet, MD, MPH, Michelle Eckerle, MD, MPH, Olga Semenova, BEc, Jareen Meinzen-Derr, PhD and Lynn Babcock, MD, MS

PREHOSPITAL EMERGENCY CARE 2018

- 20% of pediatric sepsis patients arrive by EMS
- Few get any fluids before ED arrival

3%

FEAST - Fluid Resuscitation as Supportive Therapy



- African children with severe febrile illness and impaired perfusion
- 20ml/kg fluid bolus 1 hour
- Repeated if not improved
- Fluid bolus group higher mortality (10.5% vs 7.3%)

3 Should EMS Give Whole Blood?

RePHILL

- Pre-hospital RCT
- Trauma patients (SBP
- PRBC
- domization
- g. 700mL PRBC's + LyoPlas *vs* 700 mL NS
- **Mortality: 42% (PRBC group) vs. 45% (NS group)**

Lancet Haematology 2022

Articles

Resuscitation with blood products in patients with trauma-related haemorrhagic sh… …ospital care (RePHILL): a mul… …d, contr…

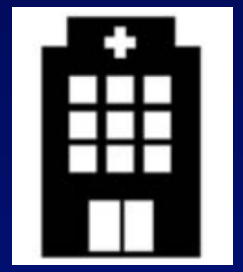
…e Leech, …lie Ives,

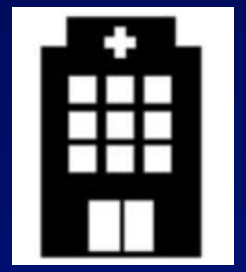
"Careful Consideration before committing to Pre-hospital Blood"

RePHILL??







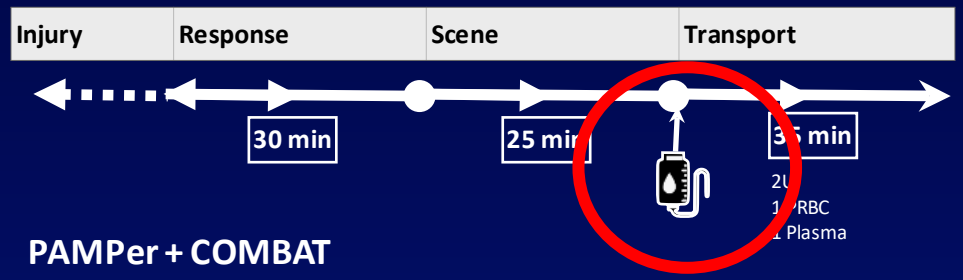


Injury	Response	Scene	Transport	Trauma Bay	Surgical Intervention	Hospital Course
Event Dispatch	Travel to Scene	Arrival Assessment Packaging	Travel En-route care			Mortality 42%

30 min → 25 min → 35 min

2 U → 11 U

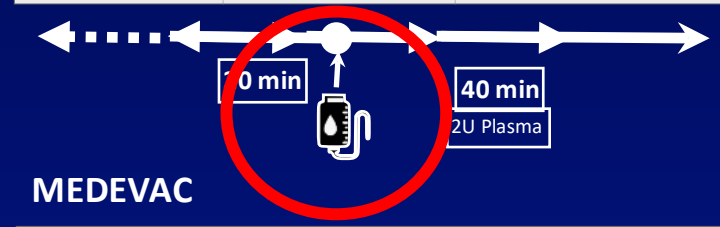
RePHILL



ISS	Pen	Blunt	NCTH	Severe TBI	Arrest	24H blood products	Mortality
36	23%	78%	82%	48%	14%	11.3 U	42% *excludes arrest

	GCS	HR	SBP	SI
Scene	8	115	73	1.6
Arrival	-	107	114	0.9

PAMPer + COMBAT



ISS	Pen	Blunt	NCTH	Severe TBI	Arrest	24H blood products	Mortality
22	28%	73%	-	34%	13%	10u (?)	20.5%

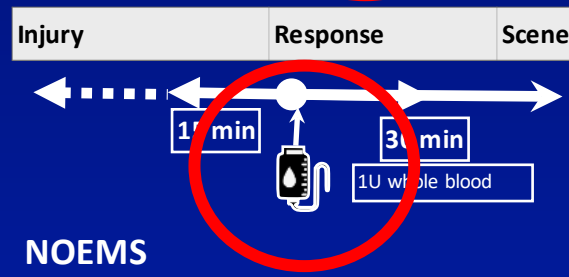
	GCS	HR	SBP	SI
Scene	-	117	82	1.4
Arrival	8	-	-	-

MEDEVAC

ISS	Pen	Blunt	NCTH	Severe TBI	Arrest	24H blood products	Mortality
29	16%	84%	56%	20%	-	15U	11%

	GCS	HR	SBP	SI
Scene	-	-	-	-
Arrival	-	-	-	-

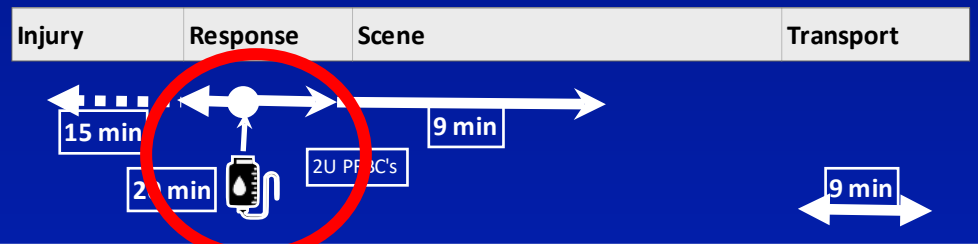
San Antonio (Braverman)



ISS	Pen	Blunt	NCTH	Severe TBI	Arrest	24H blood products	Mortality
17	59%	41%	-	-	18%	10U	22%

	GCS	HR	SBP	SI
Scene	-	113	75	1.5
Arrival	8	113	92	1.2

NOEMS



ISS	Pen	Blunt	NCTH	Severe TBI	Arrest	24H blood products	Mortality
14	89%	11%	90%	-	33%	9U	10% *excludes arrest

	GCS	HR	SBP	SI
Scene	12	110	70	1.44
Arrival	13	79	117	0.73

*preliminary data

4

Should We Give Pre-hospital Antibiotics?

THE LANCET
Respiratory Medicine

ARTICLES | VOLUME 6, ISSUE 1, P40-50, JANUARY 2018

Prehospital antibiotics in the ambulance for sepsis: a multicentre, open label, randomised trial

Nadia Alam, MD • Erick Oskam, MD • Patricia M Stassen, PhD • Pieternel van Exter, MD • Peter M van de Ven, PhD • Prof Harm R Haak, PhD • et al. Show all authors • Show footnotes

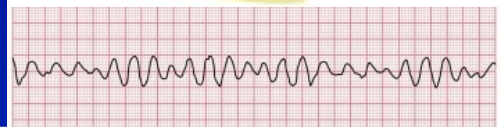
Published: November 28, 2017 • DOI: https://doi.org/10.1016/S2213-2600(17)30469-1 •

What Are the Problems with This Study?

- Mortality rate of 8% was much lower than predicted mortality (40%)
- Patients in the usual care group received antibiotics within 1 h of ED arrival.
- Hypotension was not an inclusion criteria
- Only 3% of the patients in this study were in septic shock.
- 20% of the patients were already on antibiotics before entering into the study
- Readmission rate significantly lower in the Antibiotics group

5

Should We Give Epi in Shockable Rhythms?



JAMA®
The Journal of the American Medical Association

Resuscitation From Ventricular Fibrillation

Drug Therapy

Joseph S. Redding, MD, and John W. Pearson, MD

In resuscitating dogs subjected to ten minutes of circulatory arrest due to ventricular fibrillation, a number of drugs were used with artificial ventilation of the lungs, external cardiac massage, and external electrical countershock. Resuscitation was more successful when epinephrine was used than when no drug therapy or sodium bicarbonate were used. Combination of lidocaine with epinephrine increased the frequency of defibrillation, but circulation was not restored more often than with epinephrine alone. The use of methoxamine hydrochloride was followed by successful resuscitation more often than was the use of epinephrine. Combination of epinephrine and sodium bicarbonate was as effective as methoxamine in restoring circulation, and inspection of the survivors after 24 hours suggested that the combination might be preferable.

In an earlier study[1] it was shown that either epinephrine or phenylephrine hydrochloride was a valuable addition to artificial ventilation of the lungs, external cardiac massage, and external countershock in resuscitating asphyxiated dogs with ventricular fibrillation. The use of either drug was distinctly better than the use of no drug therapy, but no difference in effectiveness between the two drugs was demonstrated. The addition of procainamide hydrochloride to the treatment did not alter the result.

The purpose of the present study was to determine whether there is a difference in effectiveness between the two vasopressors when they are used in resuscitation from ventricular fibrillation, and to evaluate several other types of drug therapy which have been advocated for this purpose.

From the Department of Anesthesiology, Baltimore City Hospitals, Baltimore.

Read before the Section on Anesthesiology at the 116th annual convention of the American Medical Association, Atlantic City, NJ, June 21, 1967.

Reprint requests to 4940 Eastern Ave, Baltimore 21224 (Dr. Redding).

Methods

One hundred and five mongrel dogs weighing between 6.8 and 13.2 kg (14.9 to 29 lb) were divided into seven groups of 15 dogs each. They were lightly anesthetized with methohexital sodium, 10 mg/kg, given intravenously, and the trachea of each was intubated with a cuffed endotracheal tube. A catheter was inserted through a femoral artery into the aorta for monitoring aortic pressure, and lead II of the electrocardiogram was recorded continuously. Another catheter was inserted 1 cm into a femoral vein for administration of drugs.

With each animal secured in the supine position and breathing air spontaneously, ventricular fibrillation was induced by a 110-volt alternating current shock applied to the chest wall for three seconds. A period of ten minutes was allowed to elapse between circulatory arrest and the start of resuscitation. Intermittent positive-pressure ventilation with air was then begun at a rate of 20 breaths per minute and tidal volumes of 25 ml/kg. External cardiac massage was started at the same time. The sternum was compressed five times during each exhalation with sufficient force to create an artificial systolic pressure of 50 to 100 mm Hg. The rate of cardiac compression was 100 per minute.

All drugs were injected into the femoral vein just before resuscitation was started. The following drugs were given: group A, no drug; group B, sodium bicarbonate (20 ml of 7.5% solution);

“She’s a Bad Mama JAMA..

..Just as fine as she can be”

JAMA®
The Journal of the American Medical Association

Epinephrine in Vfib (1968)

7 Groups of Dogs (15 in each Group) ~ 10 kg

- Induced VF for 10 minutes
- Drugs infused
- 100 compressions/min
- 20 breaths/min (25 mL/kg)
- 3 stacked shocks every 2 minutes until ROSC

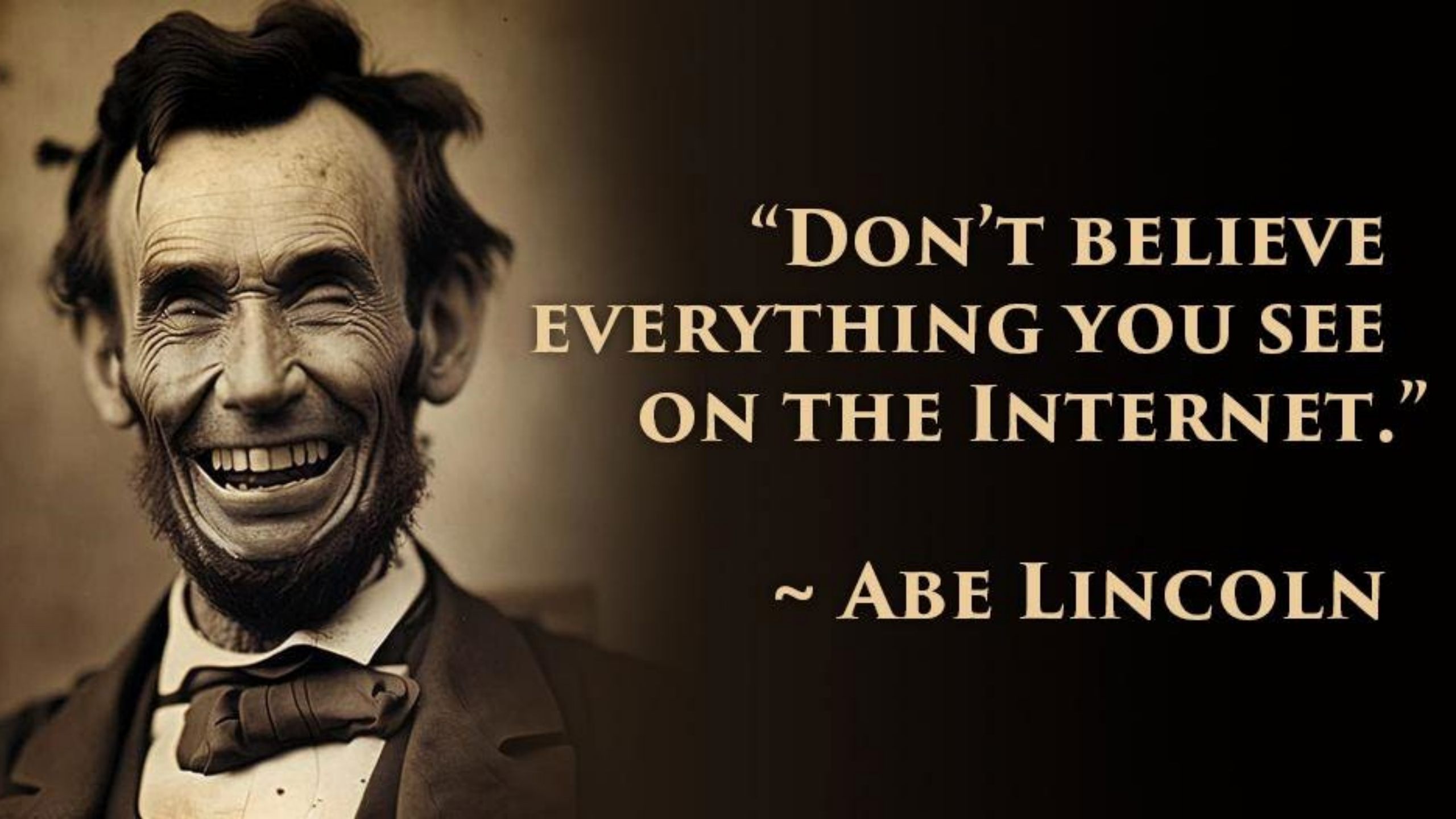

That’s Messed Up!

Table 2.—Relation Between Drug Therapy and Survival

Group*	Drug, Dose	Circulation Restored	Condition in 24 hr		
			Awake	Unconscious	Dead
A	None	1			1
B	Sodium bicarbonate, 1.5 gm	0			
C	Epinephrine, 1 mg	7	3	2	2
D	Epinephrine, 1 mg; lidocaine, 40 mg	7	1	1	5
E	Phenylephrine hydrochloride, 10 mg	10		3	7
F	Methoxamine hydrochloride, 20 mg	13	2	1	10
G	Epinephrine, 1 mg; sodium bicarbonate, 1.5 gm	13	10	1	2

*Each group contained 15 dogs.

"In this study, peripheral vasoconstricting drugs were shown to be of value in resuscitation from ventricular fibrillation."


"Don't believe everything you see on the Internet."
~ Abe Lincoln

EMS State of the Science XXIV

A Gathering of Eagles 2022

Practice Changing Studies…

That you should ignore & throw out the door

Peter Antevy, MD

EMS Medical Director

@HandtevyMD